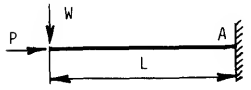
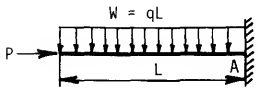
Table 24.2 Maximum Moments and Deflections for Beam Columns



$$M_{max} = W\sqrt{\frac{EI}{P}}\tan L\sqrt{\frac{P}{EI}} \quad \text{at } A$$

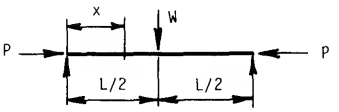
$$Y_{max} = \frac{W}{P}\left(\sqrt{\frac{EI}{P}}\tan L\sqrt{\frac{P}{EI}} - L\right) \quad \text{at free end}$$



$$M_{max} = q\sqrt{\frac{EI}{P}}\left[\sqrt{\frac{EI}{P}}\left(1 - \sec L\sqrt{\frac{P}{EI}}\right) + L\tan L\sqrt{\frac{P}{EI}}\right] \quad \text{at } A$$

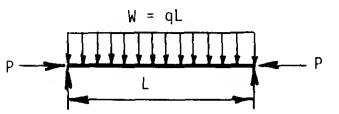
$$Y_{max} = \frac{q\sqrt{\frac{EI}{P}}}{P}\left[\sqrt{\frac{EI}{P}}\left(1 + \frac{PL^2}{2EI} - \sec L\sqrt{\frac{P}{EI}}\right) + L\left(\tan L\sqrt{\frac{P}{EI}} - L\sqrt{\frac{P}{EI}}\right)\right]$$

at free end



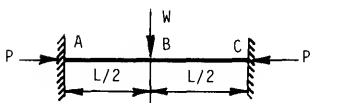
$$M_{max} = -\frac{W}{2}\sqrt{\frac{EI}{P}}\tan\frac{L}{2}\sqrt{\frac{P}{EI}} \quad \text{at } x = L/2$$

$$Y_{max} = \frac{W}{2P}\sqrt{\frac{EI}{P}}\left(\tan\frac{L}{2}\sqrt{\frac{P}{EI}} - \frac{L}{2}\sqrt{\frac{P}{EI}}\right) \quad \text{at } x = L/2$$



$$M_{max} = -\frac{qEI}{P}\left(\sec\frac{L}{2}\sqrt{\frac{P}{EI}} - 1\right) \quad \text{at center}$$

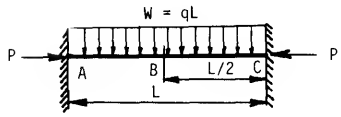
$$Y_{max} = \frac{qEI}{P^2}\left(\sec\frac{L}{2}\sqrt{\frac{P}{EI}} - 1 - \frac{PL^2}{8EI}\right) \quad \text{at center}$$



$$M_A = M_C = -\frac{W}{2}\sqrt{\frac{EI}{P}}\left(\frac{1-\cos\frac{L}{2}\sqrt{\frac{P}{EI}}}{\sin\frac{L}{2}\sqrt{\frac{P}{EI}}}\right)$$

$$M_B = -\frac{W}{2}\sqrt{\frac{EI}{P}}\left(\tan\frac{L}{2}\sqrt{\frac{P}{EI}} - \frac{1-\cos\frac{L}{2}\sqrt{\frac{P}{EI}}}{\sin\frac{L}{2}\sqrt{\frac{P}{EI}}\cos\frac{L}{2}\sqrt{\frac{P}{EI}}}\right)$$

$$Y_{max} = \frac{W}{2P}\sqrt{\frac{EI}{P}}\left[\tan\frac{L}{2}\sqrt{\frac{P}{EI}} - \frac{L}{2}\sqrt{\frac{P}{EI}} - \frac{\left(1-\cos\frac{L}{2}\sqrt{\frac{P}{EI}}\right)^2}{\sin\frac{L}{2}\sqrt{\frac{P}{EI}}\cos\frac{L}{2}\sqrt{\frac{P}{EI}}}\right]$$



$$M_A = M_C = -\frac{qEI}{P}\left(1 - \frac{\frac{L}{2}\sqrt{\frac{P}{EI}}}{\tan\frac{L}{2}\sqrt{\frac{P}{EI}}}\right)$$

$$M_B = \frac{qEI}{P}\left(\frac{\frac{L}{2}\sqrt{\frac{P}{EI}}}{\sin\frac{L}{2}\sqrt{\frac{P}{EI}}} - 1\right)$$

$$Y_{max} = \frac{qEI}{p^2}\left[\sec\frac{L}{2}\sqrt{\frac{P}{EI}} - \frac{PL^2}{8EI} - 1 - \left(1 - \frac{\frac{L}{2}\sqrt{\frac{P}{EI}}}{\tan\frac{L}{2}\sqrt{\frac{P}{EI}}}\right) \times \left(\frac{1-\cos\frac{L}{2}\sqrt{\frac{P}{EI}}}{\cos\frac{L}{2}\sqrt{\frac{P}{EI}}}\right)\right]$$